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ABSTRACT

Two digit span distraction tasks were used to compare performance of 32 learning disabled (LD) and 32 normal children (mean ages 16 and 15 years). On the first set of tasks, where the neutral and distraction conditions were matched for their ability to discriminate between groups, no differential distraction effect was found. The second task's distraction condition was designed to make it more discriminating than the neutral condition and a differential distraction effect was found. Results are discussed in terms of the need to consider the psychometric properties of research tasks as important variables and as a possible reason for disparate findings in the distractibility literature with LD Ss. (Author)

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Distractibility in Learning Disabled Children: The Role of Measurement Artifact

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Abstract

Learning disabled children have been reported to be deficient in attention and memory performance, especially selective attention in the presence of irrelevant information. But this finding has not always been replicated and it is possible that when these differential distraction effects are found, they are an artifact of the tasks' differential abilities to detect differences between the groups. Two digit span distraction tasks were used to compare performance of learning disabled and normal children. On the first set of tasks, where the neutral and distraction conditions were matched for their ability to discriminate between groups, no differential distraction effect was found. The second task's distraction condition was designed to make it more discriminating than the neutral condition and a differential distraction effect was found. These results are discussed in terms of the need for researchers to consider the psychometric properties of their tasks as important variables and as a possible explanation for disparate findings in the distractibility literature with LD children.

Several investigators have reported that learning disabled (LD) children sustain attention relatively more poorly than non-LD children when distracting information is present. This effect is present when children try to attend to visual information in the presence of irrelevant material (Pelham & Ross, 1977), as well as when the children try to sustain auditory attention in the presence of distractors (Lasky & Tobin, 1973). The usual interpretation of these findings is that LD children are using deficient rehearsal strategies which are easily disrupted by the presence of distracting information. Further evidence for this point is offered by studies which have found that LD children are deficient in recalling items presented in the primacy portion of the serial position curve, in both auditory (Bauer, 1977) and visual (Tarver et al., 1976) modalities. There are, however, other studies where there is no detrimental effect of either auditory (Dykman et al., 1970) or visual (Browning, 1967) distraction on performance. Therefore, the status of distractibility in LD children, to say nothing of the contribution of these attention deficits to actual learning problems, is in doubt.

One way of handling these conflicting data is to postulate that LD children are susceptible to the presence of certain types of distracting material and not others. Lasky and Tobin (1973), for example, found that LD children's attentional performance was impaired by linguistic irrelevant material, but not white noise of equal volume. This

approach does not work, however, for reconciling studies which have produced contradictory results in the visual modality or for the other studies which find directly contradictory results using other auditory tasks similar to Lasky and Tobin's (e.g., Nober & Nober, 1975). Another approach involves the recognition that the relatively greater performance deficit of LD children in the presence of distracting information (i.e., the interaction of groups by tasks) could be due to the inherently different psychometric properties of the neutral and distraction tasks. The magnitude of the measured difference between any two groups is a function of the actual differences and the ability of the tasks to detect the differences (Chapman & Chapman, 1973). A task's discriminating power is best indexed by its true score variance: the product of its reliability and variance. The prime determiner of both reliability and variance is item difficulty (Lord, 1952). On tasks which are very easy, everyone will have nearly perfect performance, despite the different abilities of the test takers. Similarly, on tasks which are extremely difficult, everyone will perform poorly despite different abilities of the test takers. A task of moderate difficulty will be the best discriminator of actual differences between groups of differing abilities. Therefore, if two tasks are used, and they are not equally difficult, one task may be more discriminating than the other. A group by task interaction may be created by the differential psychometric properties of the tasks.

Investigations of distractibility in LD children typically have not attempted to equate the discriminating power of neutral and distraction conditions. Tarver et al.'s (1976) study provides a convenient example. Using the Hagen (1967) visual central/incidental task, they found that LD children performed significantly more poorly than normal readers on the central task, while not differing from the normals on the incidental task. The results were interpreted by Tarver et al. as indicating that LD children had more difficulty in focusing attention than controls, as indexed by their poor central task performance. In addition, the LD children performed significantly more poorly on recall of central items presented in the primacy portion of the serial position curve. This result was interpreted as meaning that LD children were using deficient rehearsal strategies which lowered recall of items requiring more rehearsal. However, the incidental task was much more difficult for the normal children than the central (28% vs. 50% correct). Furthermore, because the difficulty of the central task was closer to the middle level of difficulty, it would be expected to be the more discriminating of the tasks. Therefore, an alternate explanation of their findings could be that the groups by tasks interaction was artificially produced by the psychometric properties of the two tasks.

Unfortunately, few published studies in the area of learning disabilities even provide the information necessary to determine if neutral and distraction tasks are matched psychometrically. Data about reliability is seldom presented and sometimes tables of means without standard deviations are listed in the articles (e.g., Lasky & Tobin, 1973; Tarver et al., 1976). This information is crucial to the meaningful interpretation of presented data, especially in light of the above indications that performance deficits in the presence of distraction may be artifactual.

The following study demonstrates the impact of manipulation of a task's ability to discriminate differences between groups. It is hypothesized that the magnitude of the difference between the performance of LD and normal children will be a function of discriminating power. Specifically, when the neutral and distractor tasks are matched for discriminating power, we expect no differential deficit (i.e., no group X task interaction). With unmatched tasks, however, we expect to replicate the results of other studies. In addition, it is also proposed that differential deficit in performance in the primacy portion of items presented during distraction will be a function of the distraction condition's ability to discriminate differences between groups.

Methods

Subjects. Subjects were 32 LD children from a special school for children with reading problems and 32 children from a local public high school. They were matched on age (LD: M=16.4, sd=2.1; Control: M=15.9, sd=1.8) and sex (19 male and 13 female). The LD children were selected for their special school on the basis of reading scores at least four years behind grade level as of 8th grade, no current hyperactivity, normal intelligence, and no behavior problems not related to "frustration at inability to learn." None of the high school controls was in a special class or presented any major reading problems. The IQ's of the normal learning control group were not available, but the full scale WISC-R IQ's of the LD group were above average ($M = 112$, $sd = 15$).

Task Description. The two pairs of attention tasks used were developed by Oltmanns and Neale (1975). In the first (matched) pair the non-distraction condition consisted on 6 digits per trial, presented at a 1 per 2 second rate in a female voice. In the distraction condition, 5 digits, also read in a female voice, were presented at the same rate, with a male voice saying 4 irrelevant digits between the presentation of each target digit. There were seven trials in each condition, presented in a random, fixed order. The two conditions were matched by Oltmanns and Neale (1975) for coefficient alpha and item difficulty. Both conditions were shown to be equally difficult and of equal variance in a wide ranging normal adult population. The second (unmatched)

pair's non-distraction condition was the same as that of the first pair. The distraction condition contained six digits, read in a female voice, with a male voice reading 4 irrelevant digits between the presentation of each target digit. There were seven trials in both distraction and non-distraction conditions. For this second pair of tasks, the distraction condition is more difficult and has greater discriminating power than the 6 digit non-distraction condition (Oltmanns & Neale, 1975).

Procedure. Both LD and normal children were tested in groups of 5 or 6. The attention tasks were tape recorded and played through without a break after 4 initial practice trials. Ample time was allowed for the subjects to write down their responses. Subjects were instructed to write nothing until the trial was over and then to write down the digits to be recalled in the order presented. All subjects were presented the matched pair of tasks first and retested approximately two months later with the pair of unmatched tasks.

Results

The scoring procedure for both tasks gave credit for a correct response only when the digit was recalled in its correct location. In order to assess serial position effects, primacy and recency for both distraction and neutral conditions was defined as the first and last two digits of each trial, respectively. For the LD group Pearson product moment correlations were calculated between full scale IQ and performance on both tasks for all

dependent measures (total score for distraction and non-distraction and difference of primacy and recency for distraction and non-distraction). All correlations were non-significant and individually accounted for less than 1% of the total variance in each score.

The means and standard deviations for performance of both groups on non-distraction and distraction conditions for the matched task are presented in Table 1. To be sure that the tasks had remained matched, coefficient alpha was computed for both non-distraction and distraction conditions and was used to generate true score variance. The reliability of the distraction condition was .74, with a variance of 75.85, yielding a true score variance of 56.02. The true score variance of the non-distraction condition was 52.28, based on a reliability of .70, with variance of 73.92. Therefore, these two conditions have nearly equal discriminating power.

Three-way ANOVA's, with age (14-16 and 17-18), sex, and group revealed that LD children performed more poorly than normal children on the total score for the non-distraction condition, $F(1,61) = 61.2$, $p < .001$, and on total score for the distraction condition, $F(1,61) = 28.21$, $p < .001$, but the interaction of groups by conditions was non-significant $F(1,61) = .28$. Also, there was no group effect for the primacy-recency difference score for either non-distraction, $F(1,61) = 1.2$, or distraction, $F(1,61) = .06$, conditions. No age or sex effects were found on any dependent measures.

Insert Tables 1 & 2 about here

Means and standard deviations for all dependent variables derived from the unmatched tasks are presented in Table 2. As anticipated, the true score variance for the conditions differed considerably. The reliability of the neutral condition was .72, with a variance of 75.06, yielding a true score variance of 54.04. The distraction condition was more reliable (.80) and more variable (90.73) than the neutral condition, with true score variance = 72.58.

A three-way ANOVA revealed that LD children performed more poorly than the normals in the distraction, $F(1,61) = 60.6$, $p < .001$ and non-distraction, $F(1,61) = 12.2$, $p < .01$, conditions. The interaction of groups by conditions was significant at the $p < .05$ level, $F(1,61) = 6.2$. In addition, the LD children performed significantly more poorly on primacy as compared to recency during distraction, as indicated by the significantly smaller, $F(1,61) = 4.8$, $p < .05$, score on the difference of primacy and recency. This primacy deficit was absent on the non-distraction task, $F(1,61) = 1.2$. There were again no age or sex effects on any of the six dependent variables.

Discussion

The results suggest that investigators who are examining the differential performance of groups across different tasks or conditions

need to attend to the psychometric properties of their instruments. As demonstrated here, a manipulation of the psychometric properties of a task can lead to the induction of a groups by conditions interaction. LD children performed as poorly on the non-distraction as the distraction task when the two tasks were matched for discriminating power. However, with the unmatched pair of tasks, LD children showed a significantly larger performance deficit in the more discriminating condition, the distraction task. In addition, effects such as the relatively poorer performance of the LD children on the primacy part of the serial position in the distraction condition can be detected only by a more discriminating task.

Therefore, any attention deficit that LD children are demonstrating is not caused by the presence of distracting information. In fact, Pelham (1979) and Ford et al. [Note I] also found that tasks matched for discriminating power did not yield a differential deficit for LD children in the presence of distraction. These studies did not, however, show that LD children's differential performance deficit in the presence of distraction can be directly manipulated by varying the discriminating power of the distraction task.

Some of the contradictory results in the area of susceptibility to distraction of LD children could be a function of

utilizing tasks with differentially discriminating distraction and non-distraction conditions.

Not all of the disparate results in the area of distractibility in LD children, however, are likely due simply to differences in discriminating power. Koppell (1979) has presented other problems in the area. The notion of attention deficits, for example, has been loosely defined. Tasks thought to measure attention deficits have measured processes ranging from short term storage of auditorally presented information to sustained visual attention to a series of presented items. Koppell found that the intercorrelations of these measures are poor.

The results of the present study, combined with those of Pelham and Ford et al., unfortunately, point out one more methodological issue that researchers need to be attentive to, in order that their time and effort not be wasted.

Reference Notes

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Footnotes

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Table 1

Task Characteristics and Between Group Performance of LD and Normal Learners on Matched Neutral and Distraction Tasks

	Non-Distraction	Distraction
Mean	75%	74%
Reliability (Coefficient Alpha)	.70	.74
Variance	73.92	75.85
True Score Variance	52.28	56.02

	Non-Distraction		Distraction	
Group	Total	Primacy-Recency	Total	Primacy-Recency
LD	.61(.15)	.07(.20)	.61(.22)	-.01(.18)
Control	.89(.13)***	.03(.12)	.87(.16)***	.00(.16)

***$p < .001$

Table 2

Task Characteristics and Between Group Performance of LD and Control Children on Unmatched Neutral and Distraction Tasks

	Non-Distraction	Distraction
Mean	78%	70%
Reliability (Coefficient Alpha)	.72	.80
Variance	75.06	90.73
True Score Variance	54.04	72.58

	Non-Distraction		Distraction	
Group	Total	Primacy-Recency	Total	Primacy-Recency
LD	.66(.16)	.00(.14)	.53(.32)	-.10(.28)
Control	.89(.13)***	.03(.08)	.87(.18)***	.02(.16)*

*$p < .05$

***$p < .001$